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The U.S. Navy Struggle with Face Mask Procurement During the Early Stage of the Novel COVID-19 Pandemic

December 2023

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Prepared for the Naval Postgraduate School, Monterey, CA 93943.

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ABSTRACT

The onset of the COVID-19 pandemic in early 2020 unveiled vulnerabilities in global healthcare supply chains, critically impacting the U.S. Navy's operational readiness. This research thoroughly explores the factors leading to this shortage, emphasizing the distinct requirements and challenges faced by the U.S. Navy. Key focus areas include China's pivotal role as a primary mask producer, procurement actions, and response to unforeseen demand spikes for masks. The research investigates how the centralization of mask production in China, along with its internal demand and export policies, significantly disrupted procurement processes and the ability to meet mask demands. Additionally, textile factories and other vendors, traditionally not aligned with medical mask production, needed to prepare for the sudden demand influx, amplifying the shortage. A cornerstone of this study is the incorporation of insights from stakeholder interviews. Key organizations, including DLA Troop Support, N95.org, and Resilinc, have provided invaluable perspectives on their experiences during the COVID-19 pandemic. This study contributes to the broader narrative on pandemic readiness, specifically tailored to the U.S. Navy.



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LIST OF ACRONYMS AND ABBREVIATIONS

AAFP	American Academy of Family Physicians
ACP	American College of Physicians
AI	Artificial Intelligence
AMA	American Medical Association
CDC	Centers for Disease Control and Prevention
COVID-19	Corona Virus Disease
CRS	Congressional Research Service
DASN [P]	Deputy Assistant Secretary of the Navy (Procurement)
DHA	Defense Health Agency
DHMS	Defense Health Management Systems
DLA	Defense Logistics Agency
DOD	Department of Defense
DON	Department of the Navy
DPA	Defense Production Act
FDA	Food and Drug Administration
GAO	Government Accountability Office
IG	Inspector General
JATF	Joint Acquisition Task Force
JMPAB	Joint Material Priorities and Allocation Board
KF94	Mask meeting South Korea's filter standards
KN95	Masks meeting China's filter standards
LTC	Lieutenant Colonel
NEXCOM	Navy Exchange
NHSP	National Healthcare Safety Program
NIOSH	National Institute for Occupational Safety and Health
NSN	National Stock Numbers
NUWC	Naval Undersea Warfare Center



N95	Non-oil, 95 percent efficiency masks
ONR	Office of Naval Research
PAPM	Principal Assistant Program Manager
PPE	Personal Protective Equipment
ROM	Restriction of Movement
U.S.	United States



I. INTRODUCTION

In an ever-evolving world marked by unprecedented challenges, the resilience and adaptability of institutions are tested. The outbreak of the COVID-19 pandemic unveiled a myriad of obstacles, and none were more critical than the shortages of personal protective equipment (PPE), including masks, faced by essential services—notably the U.S. Navy.

As the virus surged, the Navy found itself navigating uncharted waters, grappling not only with the health implications of the pandemic but also with the supply chain disruptions that threatened its operational readiness. In response to this pressing issue, this research delves into the heart of the matter—exploring the multifaceted dynamics of mask shortages during the pandemic. Through a comprehensive examination of supply chain intricacies, global dependencies, and policy decisions, this study aims to uncover the underlying factors that led to these shortages and, more importantly, propose strategies that would bolster the Navy’s ability to confront similar challenges in the future.

This investigation is not just about masks. It is about fortifying the Navy’s capacity to protect its personnel, ensure mission success, and contribute to broader global pandemic preparedness efforts. In this pursuit, we draw lessons from the past to shape a safer, more resilient future.

A. PROBLEM STATEMENT

The U.S. Navy became urgently concerned about the adequacy of personal protective equipment (PPE), particularly masks, amid the challenges posed by the COVID-19 pandemic. This critical shortage of masks has illuminated vulnerabilities in the supply chain, disrupting operational readiness and impacting the safety of Navy personnel. These shortages stemmed from a complex interplay of factors, including global supply chain dependencies, limited domestic manufacturing, and an overwhelming surge in demand. As the Navy grappled with these shortages, it became apparent that addressing the mask scarcity was not only pivotal for safeguarding the health of its personnel but also crucial for ensuring mission success and readiness. This problem statement underscores the need for a comprehensive analysis of the dynamics behind the mask shortages during the



pandemic, aiming to identify the root causes and challenges of supplying masks when needed. The goal is to inform the development of strategies that enhance the Navy's resilience and preparedness, mitigating the impact of unforeseen health crises on operational effectiveness.

B. PURPOSE STATEMENT AND OBJECTIVE

The purpose of this research is to address a critical gap in the U.S. Navy's preparedness strategies by investigating and proposing solutions to the challenges of addressing masks shortages during the COVID-19 pandemic. Our objective is to provide actionable insights that will guide the Navy in establishing robust supply chain practices and effective allocation strategies for PPE, especially face masks. By identifying strategies and lessons derived from the healthcare sector's experience and prior Navy efforts, our aim is to equip the Navy with a comprehensive toolkit to mitigate mask shortages in the face of future health crises. This work directly supports the Navy's mission to ensure the well-being of its personnel and sustain operational readiness during pandemics and other challenges.

C. RESEARCH QUESTIONS

This research seeks to address critical questions pertinent to the shortage of masks during the COVID-19 pandemic, particularly from the perspective of U.S. Navy personnel and procurement experts. Through qualitative inquiry and expert interviews, we aim to uncover insights into the challenges faced by the Navy and its procurement practices, shedding light on the root causes and impacts of the mask shortage on operational readiness. The research questions guiding this study are as follows:

1. What insights can be gleaned from the mask shortage during the COVID pandemic to bolster supply chain resilience for essential commodities, and what strategies can be formulated to ensure a consistent supply of masks and equivalent PPE during future pandemics, thereby preventing the recurrence of similar shortages?



2. What was the impact of the face mask shortage on the Navy operational readiness at the unit and the fleet level?
3. What could be done in the future to prevent a similar situation from reoccurring?

D. METHODOLOGY

This study adopts a qualitative research approach to delve deeply into the multifaceted challenges and potential solutions associated with mask shortages during the COVID-19 pandemic.

These qualitative insights provide context, capturing the human experiences, narratives, and challenges faced during the pandemic. Additionally, these narratives and firsthand accounts enrich our understanding, drawing a detailed picture of the complexities surrounding the situation.

Through this approach, we aim to provide actionable insights and context-driven recommendations that can contribute to improved pandemic preparedness and response capabilities.

E. SCOPE

Primary data is sourced from in-depth interviews with key personnel from both governmental and non-governmental organizations, including insights from Anne Miller of Project N95.org, U.S. Army Lieutenant Colonel (LTC) Edwin Caudell of Defense Logistics Agency (DLA) Troop Support, Kate Petti from the Office of the Deputy Assistant Secretary of the Navy (Procurement) (DASN[P]), and Peter Guinto of Resilinc. While the broader context of PPE shortages during the pandemic is acknowledged, the research narrows its lens primarily to masks.

1. DLA Troop Support

DLA Troop Support is a Major Subordinate Command of the Defense Logistics Agency located in Philadelphia, PA, with a global presence including offices in Europe, Africa, and the Pacific regions (Defense Logistics Agency, n.d.). It is responsible for four



supply chains which provide our nation's military and government partners with food and feeding equipment; clothing and textile items; construction and equipment materiel ranging from lightbulbs to bulldozers; and medical materiel and pharmaceuticals. DLA Troop Support provides more than \$19 billion in support to 51,000 global customers through a network of 3,700 suppliers, delivering optimal, global supply chain solutions with a focus on world-class performance and strong partnerships in support of national defense, humanitarian assistance, and disaster relief.

a. *Resilinc*

In the realm of supply chain management, Resilinc has emerged as a significant player (Resilinc, n.d.). Established in 2010, Resilinc's innovative approach to supply chain resilience has garnered global recognition. Their expansive coverage, which encompasses 95% of the world's supply chains across various industries, offers a comprehensive perspective on potential disruptions including pandemic response. Their advanced, early-warning alert systems, fortified by AI-driven predictive analytics, made Resilinc particularly relevant for this study. This system's capability to anticipate challenges, whether they be geopolitical issues, natural disasters, or unexpected events like the COVID-19 pandemic, has positioned Resilinc as a key informant on supply chain dynamics. The intention behind selecting Resilinc was not only to understand their proactive methodologies but also to gain insights into the broader shift from reactive problem-solving to preventive strategies in supply chain management. Their holistic approach to risk intelligence and mitigation offers a unique lens to study and understand the evolving challenges and solutions in global supply chains.

b. *Project N95.org*

Project N95 has made a significant impact in the response to the COVID-19 pandemic (Project N95, n.d.). Established as a national non-profit, Project N95 has been at the forefront of ensuring protection for individuals and communities during the pandemic and its aftermath. Their online shop provides equitable access to essential protective equipment like authentic N95 respirators, KN95 and KF94 masks, and specialized masks for children. Furthermore, their range extends to COVID-19 testing kits and other pivotal



products. But beyond being a mere supplier, Project N95's mission is multifaceted. Through rigorous advocacy and educational initiatives, coupled with the distribution of thoroughly vetted goods and services, they have positioned themselves as champions of safety. Their endeavors are not limited to supporting frontline workers; they extend their protective umbrella to the general public, ensuring widespread safety and resilience against the pervasive threats from the pandemic.

c. Deputy Assistant Secretary of the Navy for Procurement

Deputy Assistant Secretary of the Navy for Procurement [DASN (P)] serves as a critical component within the United States Navy, dedicated to enhancing the readiness and operational capabilities of the fleet (Office of the Assistant Secretary of the Navy [Research, Development & Acquisition], n.d.). As part of the Office of the Assistant Secretary of the Navy for Research, Development and Acquisition, DASN (P) plays a pivotal role in advancing research and development efforts that support the Navy's evolving needs. With a commitment to innovation and strategic planning, DASN (P) collaborates across various disciplines to drive progress in technologies, systems, and solutions that contribute to the Navy's mission success. Through its multifaceted initiatives, DASN (P) aims to foster resilience, preparedness, and effectiveness in addressing the challenges of today and the uncertainties of the future.

F. SUMMARY

This study explores the dynamics behind mask shortages. Through an examination of supply chain complexities, global dependencies, and policy decisions, the research aims to uncover root causes and propose strategies for enhancing Navy resilience. This chapter sets the stage for a comprehensive analysis, shedding light on the urgent need for solutions that safeguard both personnel health and operational effectiveness.



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II. LITERATURE REVIEW

This chapter delves into the challenges brought about by the COVID-19 pandemic, with a specific focus on the shortages of face masks: the evolving perceptions of face masks, their sudden increase in demand, and subsequent supply chain disruptions. The impact of these shortages on healthcare, essential services, and the U.S. Navy is examined, shedding light on the strategic vulnerabilities that emerged. This literature review encompasses an overview of the consequences and implications, highlighting the urgent need for effective strategies and solutions to address these critical shortages.

The onset of the COVID-19 pandemic ushered in a myriad of challenges on a global scale. Among these, the shortage of face masks emerged as a pressing concern, especially in the United States, given its initial surge in cases. Face masks, previously viewed as a staple for medical professionals or those in polluted environments, rapidly transformed into a symbol of safety and prevention against the virus (Arangdad & Godfrey, 2021). The different types of masks and their filtration efficiency are shown in Figure 1. As infections soared, and research began revealing the transmission dynamics of the virus, masks became a front-line defense against its spread. In the public sphere, they morphed from a medical necessity to an emblem of societal responsibility and mutual protection. Yet, as demand surged, the supply chains faltered, leading to acute shortages (Wan, 2020).







Types	Face covering masks	Surgical masks	N95 mask	Surgical respirators
				
Purpose	Prevents large particles (> 10 um) expelled by the wearer from reaching the environment	Prevents large particles (> 10 um) expelled by the wearer from reaching the environment To be used as a physical barrier to protect people from large droplets of blood or body fluids	Reduces exposure to very small airborne particles or contaminants May not protect against sprays and direct liquid splashes	Provides the protection of both a surgical mask and N95 respirator To be used as a physical barrier for large droplets of blood or body fluids as well as very small particles (e.g., fine aerosolized droplets), such as those produced by coughing
Fit	Does not fit tightly	Does not fit tightly	Tight fit	Tight fit
Filtration efficiency	Windproof, keep warm, isolate large particles such as dust	Bacterial filtration efficiency above 95%	Minimum 95% against particulate aerosols (of 0.3 micron in size) free of oil	Minimum 95% against particulate aerosols (of 0.3 micron in size) free of oil
Fluid resistance (i.e., resistance to penetration of bodily fluids)	Not fluid resistant	Yes	Not tested for fluid resistance	Tested to be fluid resistant

Figure 1. Different types of masks and their filtration efficiency. Source: Ji et al. (2020).

A. OVERVIEW OF MASKS SHORTAGE DURING COVID-19

The unfolding of the COVID-19 pandemic reshaped public perceptions and governmental policies around face masks. Initially, mixed messaging, partly driven by concerns about preserving mask stocks for medical professionals, led to public hesitancy in mask adoption. However, as studies started highlighting the masks’ role in curbing transmission, especially from asymptomatic carriers, there was a palpable shift in messaging and public sentiment as to the effectiveness of masks (Wan, 2020).

As revealed in early 2020 *Contributing Factors To Personal Protective Equipment Shortages during the COVID-19 Pandemic* article by Jennifer Cohen and Yana Rogers, studies showed the exponential increase in the need for masks after the initial outbreak within the United States. Cohen and Rogers emphasized the importance of face masks as people worldwide realized their significance, triggering a rapid and exponential increase in demand that resulted in acute shortages across the globe. This sudden surge in demand was propelled by healthcare systems aiming to safeguard frontline workers from the contagious virus, in addition to the general public’s desire for personal protection (Cohen

& Rogers, 2020). Figure 2 illustrates a steep rise in the demand for face masks during the peak of the COVID-19 pandemic.

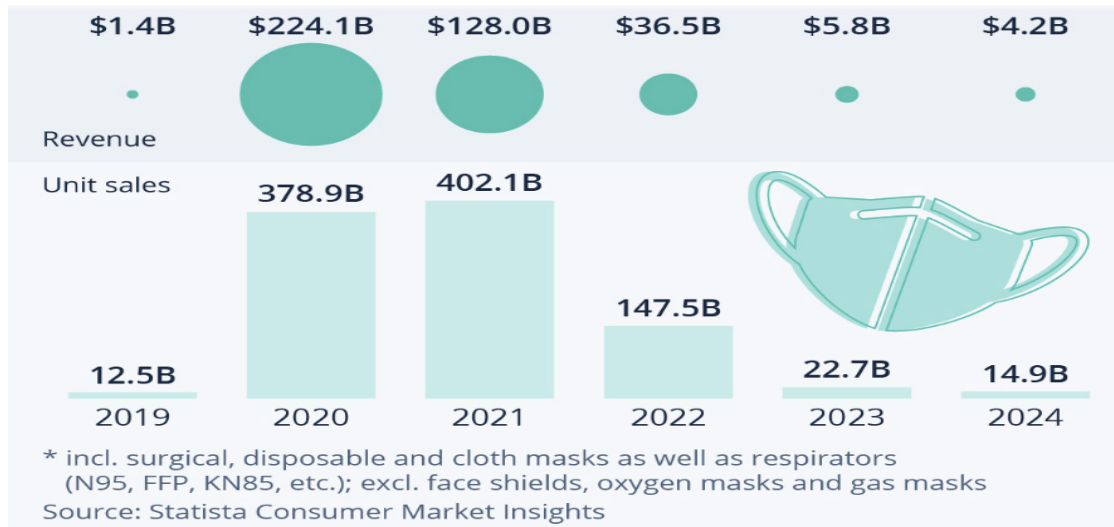


Figure 2. Increase in face mask demands during the pandemic. Source: Richter (2023).

The global supply chain’s structure for PPE including face masks was not prepared to handle such a surge in demand (Cohen & Rogers, 2020). Many countries, including the United States, had come to rely heavily on a just-in-time inventory management approach, a system that prioritizes reducing storage costs by maintaining minimal stock (Cohen & Rogers, 2020). While this approach is cost-effective under regular circumstances, it was ill-suited to handle the sudden and unprecedented demand for PPE.

Also after the initial pandemic outbreak, Wu et al. published the article *Facemask Shortage and the Novel Coronavirus Disease (COVID-19) Outbreak: Reflections on Public Health Measures* (Wu et al., 2020). Wu et al. studies have shown that supply chains struggled to keep up with demand for masks. According to Wu et al., a significant portion of its mask supply, especially the specialized N95 masks, was sourced from abroad, notably China. As noted by Wu et al., China, is responsible for producing over 50% of all surgical masks and respirators. Figure 3 shows countries that were major face mask exporters. This heavy reliance meant that any disruption in China’s production capabilities or its

willingness to export would have significant ramifications for the global supply (Congressional Research Service [CRS], 2020b). As the virus's epicenter, China faced its own internal demand surge, coupled with manufacturing slowdowns due to lockdowns, as per CRS, 2020b. This confluence of factors led to a dramatic drop in mask exports, leaving the U.S. with a dwindling supply (CRS, 2020a).

According to Peter Barringer et al. 2020 report titled *PPE Sourcing Strategy – Future Perspective*, they emphasized the inadequacy of domestic manufacturing capabilities, leading to a heavy reliance on imports and contributing to shortages. They described the limitations of domestic production capacities in the U.S. were starkly revealed during the pandemic. Despite being one of the world's largest economies, the U.S. struggled to meet domestic demand for face masks (Barringer et al., 2020).

The Government Accountability Office (GAO) report titled *Defense Production Act: Opportunities Exist to Increase Transparency and Identify Future Actions to Mitigate Medical Supply Chain Issues* states that the U.S. government, recognizing the impending crisis, took a series of steps (Russell, 2020). The Strategic National Stockpile was tapped, but it quickly became evident that the stockpile was woefully inadequate for a crisis of this magnitude (Russell, 2020). The invocation of the Defense Production Act (DPA) sought to spur domestic production mentioned in the same GAO report. However, manufacturing, even when expedited, required lead times, and the immediate demand-supply gap persisted.

In parallel, attempts to secure masks from alternative international sources often turned into high stakes bidding wars, with states, federal agencies, and other nations vying for the same limited resources (Barringer et al., 2020). Barringer et al. also stated reports of shipments being diverted or confiscated further complicated the scenario.



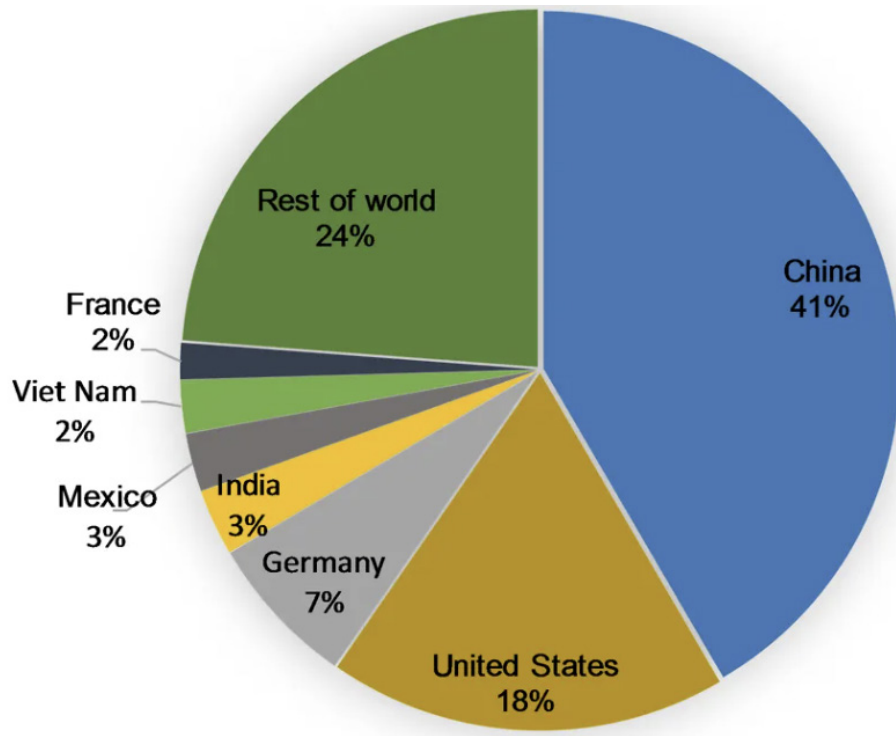


Figure 3. Major countries exporting face masks. Source: OCDE (2020).

B. IMPACT OF MASK SHORTAGES ON HEALTHCARE AND ESSENTIAL SERVICES

As described in 2020 article *America Is Running Short on Masks, Gowns and Gloves. Again* by William Wan, he mentioned the impact of the mask shortages on the healthcare professionals and hospitals (Wan, 2020). With hospitals in some regions overwhelmed by COVID-19 cases, healthcare professionals found themselves making do with dwindling mask supplies as noted in the article. Reports emerged detailing the reuse of single-use masks or the use of non-medical substitutes, raising concerns about both patient and healthcare worker safety (Wan, 2020).

Beyond the immediate health risks posed to healthcare professionals, the mask shortage also had a ripple effect on the broader healthcare system (Cohen & Rodgers, 2020). As workers fell ill, staffing shortages ensued, adding strain to an already overburdened system (Cohen & Rodgers, 2020). In the worst cases, hospitals faced the

grim reality of having to choose who to treat and who to turn away due to resource constraints as per Cohen and Rogers.

The mask shortage also impacted essential services outside of healthcare. Workers in sectors like transportation, food services, and sanitation, who were crucial to maintaining societal function during lockdowns, also faced PPE shortages (Brown, 2022). Their safety was compromised as they continued to provide essential services without adequate protection (Brown, 2022).

Governments at all levels scrambled to respond, the U.S. federal government, for instance, invoked the Defense Production Act to prioritize contracts for medical supplies and to encourage domestic production (Russell, 2020). Russell stated that despite these efforts, the response was often viewed as piecemeal and reactive, rather than coordinated and proactive.

The mask shortage also had broader economic implications. As the virus spread and healthcare systems struggled, economies worldwide went into lockdown (Barringer et al., 2020). As mentioned by Barringer et al., businesses were shuttered, unemployment rates soared, and global economies faced recessions. The lack of PPE, including masks, was a significant factor in these lockdown decisions, as governments grappled with how to protect their citizens.

The crisis prompted introspection and debate about the nature of global supply chains. While global interconnectedness offered economic benefits, it also introduced vulnerabilities. The pandemic led to discussions about reshoring manufacturing and diversifying supply sources to mitigate future risks (Barringer et al., 2020).

Moreover, the mask shortage highlighted the need for better international cooperation as mentioned in a report by Park Cyn-Young et al., titled *Global Shortage of Personal Protective Equipment Amid COVID-19: Supply Chains, Bottlenecks, and Policy Implications*. In the initial stages of the pandemic, countries enacted export bans, further straining the limited supply (Cyn-Young et al., 2020). This report also mentioned about calls for more coordinated international responses and collaborative efforts to prevent such situations in the future.



The shortage also exposed weaknesses in the U.S.'s strategic national stockpile. Pre-pandemic, the stockpile was ill-equipped to handle the sheer magnitude of the crisis, leading to calls for a reevaluation and bolstering of national reserves (Russell, 2020). As the pandemic progressed and the initial chaos subsided, efforts shifted towards longer-term solutions (Russell, 2020). There was a push for increased domestic manufacturing, investment in research and development for better PPE solutions, and the establishment of guidelines for equitable distribution of resources (Cohen & Rodgers, 2020).

C. IMPACT OF FACE MASKS SHORTAGES ON THE U.S. NAVY

The U.S. Navy's unique operational dynamics presented a distinct set of challenges during the mask shortage. This widespread shortage was not just limited to civilian healthcare providers but extended to strategic sectors, including the U.S. Navy. With personnel operating in close quarters on ships and submarines, the potential for rapid virus transmission was evident. The outbreak on the USS *Theodore Roosevelt* served as a stark reminder of these vulnerabilities (Inspector General [IG], 2020).

According to 2021 article titled *The COVID-19 Response Has Uncovered and Increased Our Vulnerability to Biological Warfare* by Reagan Lyon, the pandemic shed light on how the inability to provide adequate PPE, such as face masks, for military personnel can be exploited in biological warfare scenarios. She stated that the face mask shortage posed not just a health risk but also a strategic vulnerability. The U.S. Navy, with its global presence and closed living quarters on ships, faced unique challenges in mitigating the spread of the virus among its personnel (Lyon, 2021). The lessons learned from the pandemic response should prompt a reevaluation of preparedness strategies, ensuring that future biological threats, whether natural or deliberate, can be effectively countered.

In response, the Navy rolled out a series of measures aimed at safeguarding its personnel. From implementing stringent health checks to modifying operational procedures to reduce transmission risks, efforts were multifaceted. Yet, the mask shortage remained a serious concern. Traditional supply chains were disrupted, and the Navy had to seek alternative avenues. As described in a 2020 newspaper article titled *Navy Develops*



3D-Printed Tactical Masks for U.S. Forces Korea by Warren Duffie, initiatives like leveraging 3D printing technologies to produce masks onboard showcased the Navy’s innovative approach to crisis management.

During the pandemic, the Defense Logistics Agency’s (DLA) role in meeting the U.S. Navy’s face mask needs became increasingly pronounced. The agency, dedicated to fulfilling military logistics needs—including food, clothing, fuel, and notably, medical material—rose to the challenge of the pandemic (<https://www.dla.mil/Troop-Support/>). A substantial 5.635 million N95 masks were supplied, a critical component in safeguarding Navy personnel (CRS, 2020a). Additionally, DLA facilitated the distribution of 67.873 million non-medical and surgical masks, catering to various U.S. Navy functions, DLA Troop Support (CRS, 2020a). DLA’s efforts extended beyond just masks. Their support ensured that U.S. Navy Hospital Ships (the USNS *Comfort* and USNS *Mercy*), were equipped with essential supplies (CRS, 2020a). Figure 4 provides DLA-reported figures of certain medial materials contracted for and shipped/delivered to both DOD and non-DOD federal customers.

for August 26, 2020 (in millions)

	N95 Respirator Masks	Non-Medical and Surgical Masks	Exam Gloves	Hand Sanitizers	Testing Components	Ventilators	Isolation and Surgical Gowns
Provided to DOD/Military							
Contracted	5.635	67.873	167.764	1.271	0.241	0.003	3.092
Shipped/Delivered	4.279	58.331	144.468	1.087	0.103	0.002	1.650
Provided to Non-DOD Federal Agencies							
Contracted	0.060	2.883	5.692	0.027	6.394	0.004	0.056
Shipped/Delivered	0.026	2.655	5.176	0.023	0.001	0.004	0.025

Source: Tabulated by CRS from data provided by DLA.

Note: DLA combines “shipped” and “delivered” in its accounting because Class VIII supply is normally shipped directly to customers from vendors and guaranteed delivery is part of the DOD contract. Contracted amounts are not a cumulative total of all medical materials contracted for since the start of the COVID-19 pandemic.

Figure 4. DLA contracted for and shipped/delivered medical supplies to both DOD and non-DOD federal customers. Source: Congressional Research Service (2020a).



D. PETER KRALJIC'S MODEL

In 1983, Peter Kraljic introduced a strategic approach to purchasing in his article in the Harvard Business Review. He suggested that companies should not just buy products; they should strategically manage their supplies based on the importance and risk of those supplies.

This approach can be directly applied to the U.S. Navy's challenges during the COVID-19 pandemic. The difficulty in getting face masks is an example of the supply issues Kraljic described.

Kraljic's main idea was his portfolio management model. He said companies should sort their supplies into four categories based on how important they are and how risky it is to get them. These categories are: strategic, bottleneck, leverage, and noncritical (Kraljic, 1983). Figure 5 provides a visual representation of Kraljic's idea.



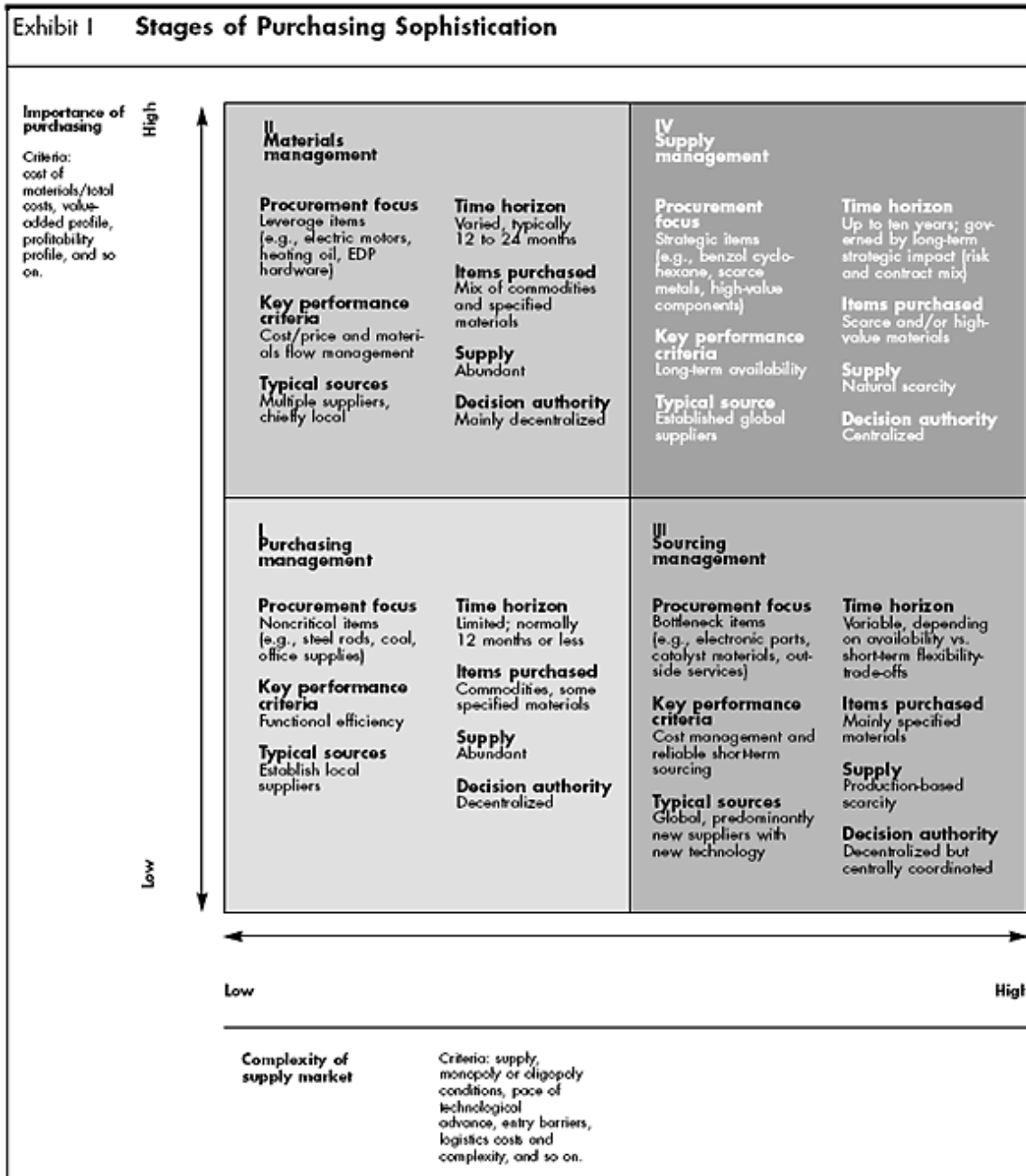


Figure 5. Stages of purchasing sophistication. Source: Kraljic (1983)

The process has four steps: figuring out what category supplies fall into, researching the market, deciding on a strategy, and making a plan (Kraljic, 1983).

Kraljic’s framework, now a cornerstone in supply management, offers insights for the U.S. Navy, especially where resource availability becomes a strategic concern,



adopting such a structured approach can significantly bolster operational resilience. Delving deeper into the U.S. Navy's adaptive measures during the pandemic, the principles of Kraljic's supply management become increasingly pertinent, highlighting avenues for strategic resource procurement and management.

E. SUMMARY

The literature review provided an overview of the challenges posed by the COVID-19 pandemic, particularly the shortage of face masks. The evolving perception of face masks, the surge in demand, and ensuing disruptions in the supply chain were examined. The chapter also investigated the profound consequences of these shortages on healthcare, essential services, and the U.S. Navy, underscoring strategic vulnerabilities. As the U.S. Navy navigated through these outcomes and implications, it becomes clear that the development of effective strategies and solutions is crucial to effectively address these critical shortages.



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III. METHODOLOGY

This chapter outlines the methodology employed for conducting the research, focusing on the challenges posed by mask shortages during the COVID-19 pandemic and the subsequent strategies adopted by the U.S. Navy.

This study adopts a qualitative research approach to deeply probe the challenges of mask shortages during the COVID-19 pandemic and the U.S. Navy's response strategies. Through case studies and interviews with key stakeholders, the research captures the real-world experiences, strategies, and challenges encountered during the pandemic.

A. RESEARCH APPROACH

The study is rooted in a qualitative methodology, aiming to capture the sentiments, narratives, and contextual realities of those who were directly involved in or affected by the pandemic. By emphasizing detailed narratives, the approach ensures that the research remains anchored in real-world experiences, providing a multifaceted perspective on the U.S. Navy's pandemic preparedness and response mechanisms.

B. RESEARCH DESIGN

The research design incorporates multiple case studies and an interview process to furnish a detailed understanding of the phenomena.

1. Case Study Design

Four distinct instances related to the U.S. Navy's response to the pandemic have been explored. Each provides insights into different strategies employed, challenges faced, and outcomes achieved, utilizing data from policy documents, operational reports, and other relevant documentation.

2. Interview Process

Interviews were conducted with representatives from four pivotal organizations central to the mask supply chain during the pandemic: DLA Troop Support, projectN95.org, Resilinc, and the DASN (P). The semi-structured interviews elicit detailed



narratives on operational challenges, decision-making processes, mask procurement experiences, and lessons gleaned.

C. QUALITATIVE METHOD AND RESEARCH PROCESS

The qualitative approach ensures a comprehensive understanding of the challenges and strategies associated with mask shortages during the pandemic.

Data sources, including policy documents, Navy-wide guidance, after-action reports, and interview transcripts, provide a multifaceted view of the U.S. Navy's pandemic response in the distribution of masks. A rigorous thematic analysis approach distilled the complex dataset into meaningful insights and findings, revealing the underlying themes that characterized the mask shortage and the Navy's response to the pandemic.

D. METHODOLOGY SUMMARY

The qualitative methodology of this study provides a detailed exploration of the mask shortages and response strategies during the COVID-19 pandemic. By synergizing case studies and interviews, the research offers actionable insights and a strong foundation for future pandemic preparedness and strategies.



IV. ANALYSIS AND FINDINGS

In an effort to understand the intricacies of mask shortages during the COVID-19 pandemic, this chapter delves into the heart of the crisis. Through case studies and detailed interviews, we explore the experiences of key individuals and organizations that played pivotal roles during this challenging period. Their firsthand accounts, coupled with a detailed analysis, aim to provide a comprehensive understanding of the strategies employed, challenges faced, and lessons learned.

A. CASE STUDIES

The case studies meticulously dissect specific instances from the COVID-19 pandemic, spotlighting the nuances of mask shortages within the Department of the Navy (DON) and the broader implications. These studies, derived from authoritative sources such as the DON's own guidelines and firsthand accounts, shed light on the strategies employed, challenges encountered, and the on-ground realities of mask procurement, distribution, and usage. By delving into these focused narratives, the analysis aims to extract actionable insights that can guide future preparedness and response efforts, ensuring that such shortages are effectively addressed and mitigated.

1. Strategic Response to a Global Crisis: The U.S. Navy's Proactive Face Covering Directives During COVID-19

a. Background

The U.S. Navy was quick to respond with guidelines addressing the use of face coverings to mitigate the spread of the virus, especially in situations where social distancing was not feasible.

b. Guidelines and Directives

A NAVADMIN, dated April 5, 2020 and overseen by VADM P. G. Sawyer, Deputy Chief of Naval Operations for Operations, Plans, and Strategy, underscored the Navy's commitment to adopt all necessary measures to ensure the health and well-being of its personnel and the nation. The NAVADMIN highlighted:



- The recommendation from the Center for Disease Control and Prevention (CDC) regarding wearing cloth face coverings in public settings.
- The mandatory use of cloth face coverings for individuals on DOD property, installations, and facilities when six feet of social distance couldn't be maintained. This included military personnel, Navy civilian employees, family members, Navy contractors, and all others present on the said premises.
- Exceptions to this directive could be granted by local commanders, but all personnel were directed to be prepared to lower their face coverings for identification verification by security forces.
- The face coverings were instructed to fit snugly, cover the area from the nose to the chin, be secured with ties or ear loops, preferably consist of multiple layers if made from cloth, and allow unrestricted breathing. Full face coverings, such as ski masks, were not authorized.
- Until official uniform face coverings were produced, personnel were authorized to wear medical or construction-type masks or any cloth covering, such as bandanas or scarves.

The NAVADMIN also hinted at the future availability of official Navy uniform face coverings for sailors.

c. Analysis

The U.S. Navy's swift response in implementing face covering guidelines underscores the importance of adaptability and proactive planning in times of crisis. By aligning with CDC recommendations and providing clear guidelines on the type and manner of face coverings, the Navy showcased its commitment to the safety of its personnel and the broader community. This case study serves as an example of how large organizations can efficiently respond to evolving challenges, ensuring both operational continuity and the safety of their members.



2. Uniform-Integrated Face Coverings: The U.S. Navy’s Adaptation to COVID-19 Protocols

a. Mask Mandates and Guidelines

Another NAVADMIN released on July 8, 2020, under the oversight of Vice Admiral John B. Nowell, Jr., Deputy Chief of Naval Operations for Personnel, Manpower, and Training (N1), elucidated the Navy’s stance on face coverings. This NAVADMIN provided detailed criteria for face coverings:

- Emphasis on snug fit, coverage from nose bridge to chin, and compatibility with eyewear.
- Guidelines on appearance and color, with a preference for neutral colors or matching camouflage patterns for respective uniforms.
- Specifications on the material, emphasizing multiple layers for efficacy, while ensuring breathability across varied conditions.

b. Procurement and Distribution

To facilitate accessibility and uniformity, the directive also provided information on procuring face coverings:

- The authorization of individually made or commercial face coverings provided they meet the stipulated guidelines.
- Options for command units to procure through the DLA or Navy Exchange (NEXCOM) with National Stock Numbers (NSN) assigned for various colors, facilitating bulk orders.

c. Communication Channels and Queries:

Understanding the potential for questions and the need for clarity, the NAVADMIN directed personnel to specific contacts for further information and clarification, both regarding the NAVADMIN itself and specific queries about DLA face coverings.



d. Analysis

By aligning with health recommendations, offering clear procurement channels, and setting standards for mask wear in uniform, the Navy showcased its commitment to personnel safety without compromising on operational protocols.

3. Managing COVID-19 Outbreak on the U.S. Warship *Chafee*

a. Introduction

The U.S. warship *Chafee*, a guided-missile destroyer, found itself grappling with a COVID-19 outbreak among its crew after pulling into San Diego for training from Hawaii. While the exact numbers were not disclosed due to Pentagon policy, internal documents and testimonies from sailors suggest a significant impact. The outbreak affected several divisions onboard including the food service, information technology, weapons, and engineering department, thereby raising numerous questions and concerns about the health of the crew and the ship's operational readiness.

b. Objective

The primary objectives of this case study are to understand the factors that contributed to the COVID-19 outbreak on the *Chafee*, evaluate the immediate response mechanisms put in place, assess the impact on crew morale and operational readiness, and to recommend future management strategies for similar outbreaks.

c. Factors Contributing to the Outbreak

Multiple factors contributed to the outbreak on the *Chafee*. The nature of life on a warship involves close living and working conditions, making it a hotbed for virus transmission. Additionally, despite an initial plan for "all hands antigen testing," not all crew members were tested upon arrival in San Diego. Communication gaps were also evident as sailors reported receiving insufficient information about the outbreak, further contributing to stress and uncertainty.



d. Immediate Response Evaluation

The immediate response to the outbreak had its positives and negatives. On the positive side, all sailors who tested positive were isolated to prevent further spread of the virus. A “Restriction of Movement” (ROM) personnel tracker was used to monitor affected sailors, and no sailors required hospital treatment, suggesting that cases were mild among those infected. On the negative side, the failure to test all crew members left the full extent of the outbreak unknown. There was also an inadequate supply of N95 masks. Crew members were forced to reuse masks, putting the sailors’ safety at risk. Figure 6 gives an example of two masks that were not in the best conditions but were still used due to mask shortages.



Figure 6. Face masks reused during COVID-19 outbreak on USS *Chafee*.
Source: Zeizulewicz (2021).

e. Impact on Crew Morale and Operational Readiness

The outbreak had a pronounced impact on the morale and operational readiness of the crew. Closure of amenities like the galley and gym, along with threats to close the smoking area, had a negative impact on morale. Sailors reported feeling “defeated” and

stressed, with junior sailors showing signs of significant anxiety, Navy Times (<https://www.navytimes.com/news/your-navy/2021/01/29/people-are-scared-covid-19-outbreak-rattles-crew-of-the-warship-chafee/>). This raises concerns about their long-term mental health and retention in the Navy. Additionally, the outbreak had cast doubt on the ship's ability to meet its mission objectives, given the significant portion of the crew affected.

f. Recommendations

Several recommendations can be made to better manage similar outbreaks in the future. Immediate and regular COVID-19 testing for all crew members is essential. There must also be a constant supply of necessary PPE, especially N95 masks. Clear and regular communication is crucial to keep the crew informed about the situation and the measures being taken. Mental health resources should also be introduced to help the crew cope with the stress and uncertainty. Lastly, mission objectives and timelines should be reevaluated in light of the outbreak.

g. Conclusion

The COVID-19 outbreak on the U.S. warship *Chafee* serves as a cautionary tale for military and other close-quarter operational environments. Lessons learned from this experience should inform future preparedness and response strategies, aiming to safeguard both the health and operational readiness of crew members.

4. Navy Develops 3D-Printed Tactical Masks for U.S. Forces Korea

a. Introduction

After recognizing the urgency of PPE shortages, the Office of Naval Research (ONR) Global TechSolutions took a proactive approach. They initiated a project to develop 3D-printed face masks specifically designed for warfighters, aiming to provide a more secure and effective form of protection.



b. Objectives

The primary objectives of this initiative were threefold. First, the project aimed to develop a prototype of a 3D-printed mask that could be integrated with existing tactical gear, such as combat helmets and protective visors. Second, the mask needed to form a tighter seal around the nose and mouth to minimize the risk of infection. Finally, the project sought to scale up the production of these masks to meet the immediate and pressing needs of military personnel stationed in South Korea.

c. Partners Involved

Collaboration was key to the success of this initiative. The project involved multiple partners, including ONR Global TechSolutions, the U.S. Army's Combat Capabilities Development Command, U.S. Forces Korea, and the Naval Undersea Warfare Center (NUWC) Division Keyport.

d. The Challenge

The initial challenge lay in the severe shortage of PPE, exacerbated by South Korea's status as a COVID-19 hotspot. The "hobby-grade" 3D printer available at Camp Humphreys was capable of producing only seven masks per day, a rate insufficient to meet the demand. This limitation necessitated a creative and scalable solution.

e. The Solution

The project was spearheaded by Mark Buffum, the ONR Global science advisor assigned to U.S. Forces Korea. Buffum coordinated with the U.S. Army's Combat Capabilities Development Command to secure a donation of bulk filter material and a mask design. He then reached out to TechSolutions, which agreed to sponsor a multi-faceted project. This included the development of several 3D-printed prototypes, the production of 500 3D-printed masks in various styles, and the creation of resin molds to increase production capabilities.



f. Technology Used

The project utilized medical-grade plastic for the 3D-printing of the masks. Industrial-grade 3D printers at NUWC Keyport were employed to ramp up production. Additionally, resin molds were developed to enable even hobby-grade 3D printers to produce more masks, thereby increasing the overall output and making the solution more versatile.

g. Results

The project successfully developed multiple prototypes designed for use with tactical gear. NUWC Keyport's industrial-grade 3D printers were able to manufacture hundreds of masks per day. The introduction of resin molds also allowed for a substantial increase in daily production using hobby-grade 3D printers.

h. Conclusion

The prototype masks were under evaluation by U.S. Forces Korea and the Army's Combat Capabilities Development Command. The project was seen as a model for rapid response to emergency PPE needs, not just within the Department of Defense but also in civilian healthcare settings during future health crises. The ONR Global TechSolutions initiative served as a compelling example of how innovation and collaboration can address urgent challenges.

B. QUALITATIVE INTERVIEW RESULTS

The complexities of the mask shortage during the COVID-19 pandemic cannot be captured solely through quantitative assessments or broad overviews. To truly grasp the depth and breadth of the challenges faced, and the strategies employed, it is crucial to turn to firsthand accounts from those who were on the front lines of response and mitigation efforts. The following section delves into detailed interviews conducted with key personnel from both non-governmental and governmental entities. These interviews provide invaluable insights, shedding light on the intricate dynamics of supply chains, demand forecasting, policy decisions, and strategic innovations. Anne Miller from Project N95.org, Peter Guinto from Resilinc, LTC Edwin Caudell from DLA Troop Support, and Kate Petti



from DASN (P) graciously shared their experiences, expertise, and perspectives, painting a vivid picture of the multi-faceted response to the mask shortage crisis. Their narratives are not simply accounts of past events but are instrumental in informing future strategies and preparedness measures. Navigating through the analysis of these interviews, consider them as windows into the real-world challenges, decisions, and innovations that shaped the course of the pandemic's mask supply response.

1. Interview from Anne Miller at ProjectN95.org

Ms. Miller's background is anchored in the commercialization of new medical technology, encompassing a deep understanding of product life cycles and regulatory frameworks for medical devices. Drawing upon this expertise, she was instrumental in establishing vetting procedures for PPE during the pandemic, especially given the influx of counterfeit products.

a. Role in COVID-19 Response

Anne Miller's involvement with Project N95 commenced early on, joining as a volunteer in sourcing during the nascent stages of the project in March 2020. By September 2020, she had taken over as the Executive Director. The project initially concentrated its efforts on addressing the acute shortage of PPE for healthcare professionals. This focus, however, gradually expanded to cater to frontline workers and eventually the broader population, reflecting the growing understanding of the airborne transmission of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

b. Challenges and Responses

Miller highlighted that the disparity between projected and actual mask requirements represented one of the significant challenges. Initial estimates by professional societies like the American Medical Association (AMA), American Academy of Family Physicians (AAFP), and American College of Physicians (ACP) greatly underestimated the demand. For instance, while the ACP had originally estimated orders for 10,000 masks, the actual demand exceeded 150,000 N95 masks. This gross miscalculation underscores the unpredictability of the pandemic and the immense pressure it placed on supply chains.



In terms of production, Miller emphasized the importance of prioritizing domestic or nearshore production for N95 masks. She stated, “We should be contracting for all N95 needs with domestic (onshore or near shore) production. Only when demand outstrips supply should we rely on overseas production. Taxpayer dollars went into standing up new domestic manufacturing and then government wouldn’t contract with these [National Institute for Occupational Safety and Health] (NIOSH) approved manufacturers because they hadn’t been around long enough, and price was not as low as the Chinese product. These products should be deemed medical countermeasures. Contracting should be expanded to include newer domestic manufacturers.” Unfortunately, the manufacturers’ short operational history and the allure of cheaper products from overseas affected the domestic shortage at the beginning of the pandemic.

c. Recommendations for Future Preparedness

Looking ahead, Miller suggested a pivot towards domestic or nearshore production for N95 masks needs. When demand surpasses supply, only then should there be a reliance on overseas production. Miller added, this reliance impacted the dependency of the United States on other foreign countries for masks and this dependency led to a shortage in mask supplies.

Furthermore, Project N95 suggested a collaborative consortium approach to the government. In this model, the government would provide essential raw materials, while domestic manufacturers would pledge to produce N95 masks at a competitively low fixed price. The government and Project N95 would then distribute these masks to communities with pressing needs.

d. Concluding Remarks

In her concluding thoughts, Miller highlighted a looming concern. Various states, now equipped with large stockpiles of masks, are uncertain about their subsequent utilization. Given that these masks were procured with public funds, Miller suggests that they be integrated into a stockpile accessible by underserved communities. However, manufacturers might resist this approach as redistributing existing stocks could impede



their sales. Without strategic planning, millions of masks risk being discarded, leading to environmental and economic implications.

2. Interview Results from Peter Guinto at Resilinc

Peter Guinto, with his distinctive blend of experience in healthcare and defense acquisition, played a pivotal role in the face mask procurement process during the pandemic. His tenure as an in-house counsel for defense acquisition at Wright Patterson Air Force Base and his prior role as a respiratory therapist for Cleveland Clinic, equipped him with a unique perspective to address the challenges posed by the pandemic.

a. Leadership Role in Pandemic Response

Peter Guinto's distinct background positioned him at the heart of the Air Force acquisition task force during the pandemic. Entrusted with a leadership role in the acquisition task force for face masks, Guinto headed what was known as "line of effort one." This team was tasked with capacity enhancement investment work, specifically focusing on drafting contracts to bolster mask manufacturing capacity. The Defense Production Act Title III was a crucial instrument in advancing this initiative. Under this act, contracts amounting to \$5 billion were executed within six months. Guinto's leadership also extended to the market intelligence cell, which was responsible for procuring face masks not just for the Air Force but also at the DOD level.

b. Demand Analysis and Challenges

One of the significant challenges the task force grappled with was reconciling the vast, often exaggerated, demands with the finite supply. According to Guinto, the Armed Forces including the Navy, had requested more masks than genuinely required. This necessitated a comprehensive analysis to determine the Navy's actual needs.

From a manufacturing perspective, data collection posed another challenge. Information was being sourced from the National Healthcare Safety Program (NHSP) overseen by the CDC. Additionally, the Defense Health Management Systems (DHMS) Data Agencies, which are entities responsible for the collection, management, and analysis of health-related data within the Department of Defense, were also consulted. However,



discrepancies in the reported numbers were evident. At the height of the pandemic, a stock of 22 million N95 masks was reported across all DOD facilities. As stated by Guinto, “millions of stockpiled masks were useless as a leak in the facility’s roof caused spoilage of the masks.” Additionally, masks have a shelf life and many of them were expired, which made them useless.

c. Procurement Challenges and Solutions

The global dependence on China for mask production, coupled with the lockdown, significantly hampered mask availability. To counteract this, an airlift project was initiated, involving a collaboration between the DOD, White House, and U.S. commercial airlines. Large airliners, flying without passengers, were dispatched to China to retrieve as many masks as possible. On their return, the masks were strategically distributed based on the emerging “hot spots” for COVID-19 surges.

Furthermore, to extend the utility of the masks, collaborations were established with companies like Battelle, known for their technology that sterilized N95 masks. This initiative led to the establishment of multiple decontamination centers across the United States.

d. Recommendations for Forward Thinking

Guinto emphasized the importance of data-driven decision making, even in high-pressure scenarios. Guinto described the overall problem as the distinction between demand and actual need. The Navy’s inflated requests served as a case in point, underscoring the challenges faced by the task force in discerning genuine requirements from exaggerated demands. This distinction is pivotal, especially in crisis situations where resources are limited and need to be allocated judiciously.

Moreover, Guinto shed light on the pitfalls of the traditional stockpiling approach. Traditional stockpiles, while useful, have inherent challenges—products have expiration dates and storage conditions can sometimes compromise the integrity of the stored items, as seen with the mask spoilage in certain warehouses. He stated, “to prevent a future mask shortage during the next pandemic, the U.S. government needs to create a ‘living stockpile’



of masks.” He suggested an active rotation of the stock, ensuring that products are always in use and replenished, thereby maintaining the stock’s freshness. This strategy not only ensures readiness in times of crises but also supports the consistent demand that domestic industries require to remain viable.

Guinto’s concerns about one-time large purchases from overseas resonate with broader concerns about global supply chain vulnerabilities. Such purchases, while providing immediate relief, can have long-term repercussions, potentially weakening domestic capacities. The inadvertent strengthening of foreign competitors, especially in critical sectors, can have strategic implications beyond just economic concerns.

e. Concluding Analysis

Guinto’s insights highlight the tangible hurdles and decisions made during the pandemic’s mask procurement process. With experience in both healthcare and defense acquisition, he highlighted the tension between urgent demand and limited supply, especially given global dependencies. His emphasis on discerning genuine requirements from exaggerated demands, and the need for a more dynamic stockpiling approach, underscores the importance of adaptability and data-driven strategies in crisis situations.

3. DLA’s Pivotal Role in Medical Supplies During COVID-19: Insights from LTC Edwin Caudell

LTC Edwin Caudell brings with him deep-rooted expertise from the DLA, an entity that became the linchpin of logistical support amidst the COVID-19 pandemic. His insights draw from the frontline of challenges and strategic solutions that emerged in the realm of medical supplies, especially face masks.

a. Background and Role During the Pandemic

LTC Edwin Caudell’s journey with DLA is intertwined with the agency’s key functions of acquisition, distribution, and readiness, particularly for medical materiel programs. As the pandemic intensified, DLA’s role within the DOD became even more critical, with enhanced coordination among Combatant Commands, Military Departments, and the Defense Health Agency (DHA). Additionally, DLA collaborated with other federal



agencies and commercial partners, such as the Department of Health and Human Services and key medical supply distributors. From the early tremors of the pandemic in February 2020, DLA's response was quick, with a focus on regions like INDOPACOM, including nations such as South Korea and Japan.

b. Challenges in Meeting the Demand

The pandemic-induced surge in the global demand for medical supplies, notably the N95 masks, posed immense challenges. Manufacturers, grappling with this sudden spike, placed restrictions on quantities that could be purchased based on historical demands. This constrained DLA's Prime Vendors, making it challenging to cater to the rising orders. According to LTC Caudell, "Despite these challenges, DLA's foresight was evident when they had access to around 4 million N95 masks at the onset of the pandemic, highlighting their state of preparedness."

c. Contracting and Supplier Challenges

The global demand surge brought to light the vulnerabilities in contracting. The overwhelming demand outpaced the production capacities of established vendors. While DLA identified new vendors, a myriad of challenges cropped up, ranging from vendor accreditation to the intricacies of the contracting process. Vendor accreditation was challenging as DLA had to determine which companies were legitimate to produce masks on a large scale. Prior to COVID-19, the amount of mask specialized textile companies in the United States was very small. According to DLA, the agency had limited options to purchase masks and companies outside the United States lacked the appropriate accreditation. The lack of accreditation prevented DLA from awarding contracts at the start of the pandemic. However, the agency's agility was on display as the pandemic progressed, with DLA onboarding more vendors, thus augmenting their supply capabilities. Key players in this supply chain, such as Cardinal and Owens & Minor, ensured that most of the masks sourced were domestically produced.



d. Lead Times and Delivery

Vendor-specific lead times oscillated, based on their capacity and the relentless demand. In the initial phases, when demand surpassed vendor capabilities, the Joint Materiel Priorities and Allocation Board (JMPAB) played a pivotal role in allocation management. As the industrial dynamics adjusted to the new normal, DLA and its vendors streamlined operations, with most orders getting fulfilled within a 24–72-hour window. The efficiency of DLA’s transportation contracts and systems was evident, with no major transportation hitches reported.

e. Concluding Analysis

LTC Caudell’s narrative unveils the manifold logistical challenges DLA encountered and the innovative strategies they deployed in response. One of the key takeaways from DLA’s experience during the pandemic was the imperative of adaptability. The agency learned the importance of diversifying supply sources, enhancing vendor collaboration, and the need for a more flexible and robust supply chain infrastructure. Another lesson was the criticality of real-time communication and coordination among various agencies to ensure timely and effective responses. DLA’s proactive approach, combined with their ability to scale operations rapidly, underscored their resilience and commitment. LTC Caudell’s insights illuminate not only the challenges faced but also the lessons learned, which can be instrumental in refining future preparedness and response strategies.

4. Interview Results from Kate Petti at Deputy Assistant Secretary of the Navy, Procurement Division (DASN [P])

Kate Petti has extensive experience spanning over 13 years in the Department of the Navy (DON), where she occupied various roles as a contract specialist, warranted contracting officer, and procurement analyst. Her rich expertise in the general schedule occupational contracting series, 1102, offers a unique lens into the challenges and strategies prompted by the COVID-19 pandemic.



a. *Background and Role During the Pandemic*

Petti’s comprehensive background in the DON has been primarily centered around contracting. However, during the COVID-19 pandemic, she took on a different mantle in the Joint Acquisition Task Force (JATF). While not directly involved in contract execution, she held the position of Principal Assistant Program Manager (PAPM) for Additive Manufacturing (AM) and Organic Capabilities within the “JATF N95 Respirator and Surgical Mask Product Team,” often referred to as the “Mask Team.” This team was laser-focused on discerning immediate solutions to bridge the evident gap between the soaring demand and limited supply of N95 respirators and surgical masks. Their strategy was rooted in meticulous market research, aiming for immediate procurements and scouting opportunities for domestic industrial expansion.

Her tasks were many, from delving deep into market research for N95 respirators and surgical masks suitable for clinical environments, to assessing 3D print mask designs tailored for non-medical personnel. Among her chief concerns was industry outreach, coupled with market research focused on domestic industrial base expansion endeavors.

b. *Demand Analysis and Challenges*

The pandemic unveiled a series of challenges in the PPE supply chain. While the healthcare sector’s need for surgical masks was pressing, the DOD grappled with a concurrent surge in demand for individuals pivotal to national security functions. Surgical masks designated as Class II medical devices, devices that have a moderate to high risk to the patient or user, under the scrutiny of the Food and Drug Administration (FDA) had to adhere to stringent standards. The onset of the pandemic witnessed a burgeoning number of companies venturing into producing these masks. However, this uptick also underscored the pronounced dependency of the United States on foreign sources according to Petti.

c. *Challenges in Procurement and Supply Chain*

Protection of healthcare workers, particularly from respiratory transmission of pathogens, was paramount. Surgical masks, pivotal in infection control, were in high demand, both for healthcare settings and for individuals pivotal to the nation’s security.



However, the increasing demand for these masks laid bare to the nation's over-reliance on foreign sources. The challenges were multifaceted, ranging from ensuring product authenticity to grappling with inflated prices due to the soaring demand. Moreover, scheduling bottlenecks, potential losses from foreign suppliers, and the overarching challenge of meeting production and capacity milestones further complicated the scenario. Hence, establishment of the JATF.

d. Recommendations and Forward Thinking

The insights from Petti highlight the crucial need for a robust domestic supply chain. The challenges faced during the pandemic underscore the vulnerabilities in the current system, especially the over-reliance on foreign sources for essential items like PPE. A more resilient and self-reliant supply chain, bolstered by domestic industrial expansion and stringent quality control, would be pivotal in navigating similar challenges in the future.

e. Concluding Analysis

Petti's insights provide a deep dive into the intricacies of procurement and supply chain challenges during a global crisis. Her unique position in the DON and her role in the JATF during the pandemic offers a comprehensive understanding of the challenges faced, strategies employed, and the lessons that can be derived for future preparedness. Her perspective underscores the pressing need for domestic expansion, quality control, and a strategic overhaul of the current procurement system.

C. SUMMARY

Applying Peter Kraljic's model introduced in the literature review and insights in the context of the U.S. Navy's COVID-19 response from this chapter expose the crucial procurement and increasing complexity of the supply market for something as simple as face masks. A pandemic response quickly becomes a supply management challenge which must be properly prepared for. The Navy must recognize in the early stages of a pandemic the bottlenecks in the supply chain and strategic procurement items. Collaborations like those with ProjectN95.org and leveraging 3D-printed masks highlighted by the U.S. Forces



Korea initiative present examples of appropriate reactions. The Navy must capture the lessons learned and apply this knowledge to future pandemics. This will provide an improved procurement response for unplanned supplies.

The challenges of mask shortages are vividly presented in the chapter's case studies and interviews. A recurring theme is the need for a robust domestic supply chain, accurate demand forecasting, and collaborative approaches. Narratives from Anne Miller, Peter Guinto, LTC Edwin Caudell, and Kate Petti emphasize adaptability, collaboration, and foresight.

In summary, the U.S. Navy's COVID-19 response, when viewed through Kraljic's lens, underscores the strategic significance of procurement and supply chain resilience. The pandemic's lessons advocate for a more structured procurement approach.



V. CONCLUSIONS AND FUTURE WORK

In this concluding chapter, the challenges the U.S. Navy confronted during the COVID-19 pandemic are revisited, highlighting the strategies employed, outcomes secured, and lessons learned. The necessity of the pandemic demanded rapid and dynamic adjustments, showcasing the Navy's resilience while also uncovering areas for enhancement. Building on the detailed analyses and findings from the earlier chapters, this section aims to synthesize pivotal conclusions, propose actionable recommendations, and chart pathways for future research. The overarching ambition is to bolster the U.S. Navy's readiness for any forthcoming crises, drawing from the profound insights acquired during the present pandemic ordeal.

A. OVERVIEW

At the outset of this research, the primary aim was to delve deeply into the challenges and responses of the U.S. Navy during the COVID-19 pandemic, particularly focusing on mask shortages and the subsequent adaptations. The meticulous investigation highlighted the complexities of supply chain disruptions, the Navy's proactive measures to mitigate risks, and the broader implications for operational readiness. The study's findings underscore the Navy's agile strategies amidst the crisis while also spotlighting opportunities for improvement. The following succinctly revisits these objectives and encapsulate the study's seminal conclusions.

B. KEY CONCLUSIONS

1. Impact of the Pandemic on the U.S. Navy

The COVID-19 pandemic significantly impacted the U.S. Navy's operational readiness and personnel safety. With the introduction of the Navy's Face Masks NAVADMINs during COVID-19, the Navy had to strike a balance between ensuring national defense and prioritizing the health of its members. These NAVADMINs, while vital in mitigating the spread of the virus, necessitated substantial operational adjustments. The need to swiftly implement and enforce these safety protocols underlined the Navy's



resilience, but it also added layers of complexity to daily naval operations, potentially affecting deployment schedules, training regimes, and overall naval morale during these trying times.

2. Response Strategies and their Efficacy

In confronting the COVID-19 pandemic, the U.S. Navy instituted several crucial strategies. One notable directive was the Face Masks NAVADMIN, which mandated the use of face masks in specific settings, such as crowded operational environments, and during interactions where social distancing could not be maintained (NAVADMIN, 100/20).

Additionally, there were significant adjustments to operational procedures and protocols, including alterations in ship deployment schedules, enhanced onboard medical screenings, and the establishment of quarantine periods for personnel before embarking on naval vessels. Evaluating these strategies underscores the Navy's success in mitigating immediate threats, but also points to areas that might benefit from additional enhancements or modifications.

3. Lessons Learned

In navigating the challenges posed by the COVID-19 pandemic, the Navy's response illuminated both effective strategies and areas for improvement:

a. Effectiveness of NAVADMINs

The Navy's early implementation of NAVADMINs, particularly after the USS *Theodore Roosevelt's* outbreak and resulting quarantine, highlighted the critical role of timely policy interventions. These simple directives played a significant role in risk mitigation.

b. Operational Adjustments

The need to modify traditional naval operations became clear when ships had to return to port due to outbreaks. The integration of face coverings in the Navy's uniform protocols and the strategies adopted to maintain operational readiness during the USS



Theodore Roosevelt's outbreak showcased the Navy's ability to adapt quickly to evolving challenges.

The Navy also extended the deployment cycle for ships without COVID cases during the pandemic. This allowed ships with COVID cases more time to address their situations and prepare to become operational again.

c. Supply Chain Vulnerabilities

Insights from the analysis highlight the complexities and critical importance of a resilient and adaptable supply chain system. Ensuring the consistent availability of essential items, such as face masks, during a global crisis is an area that demands more robust strategies and systems in place.

C. RECOMMENDATIONS

The deep dive into the challenges and strategies during the COVID-19 pandemic, especially focusing on the U.S. Navy's response and its face mask policies, brings forth several key recommendations. These are derived from the insights gathered from case studies, qualitative interviews, and the overall analysis of the Navy's approach.

1. Policy Refinement

Objective: Fortify the robustness and clarity of NAVADMINs

Action Item: Given the insights from "Navigating Mask Protocols: Insights from the Department of the Navy's COVID-19 Guidelines," from Chapter IV, it is crucial to regularly revisit and adjust the NAVADMINs. Feedback from units like the USS *Theodore Roosevelt*, which faced a significant outbreak without sufficient masks, can be invaluable in this process. Regularly updating the NAVADMINs, especially by integrating direct feedback from frontline units that faced the brunt of such crises, is imperative to ensure the guidelines remain both relevant and effective.

2. Operational Preparedness

Objective: Augment the readiness of the Navy in confronting health-related crises.



Action Item: The case study from Chapter IV, “Operational Readiness Amid Pandemic: The USS *Theodore Roosevelt*’s COVID-19 Outbreak and Its Strategic Implications,” presented a clear imperative to strengthen preparedness measures. The Department of Defense should expand pandemic response during humanitarian and disaster relief wargame scenarios. Establishing a dedicated wargaming program that regularly simulates pandemic scenarios, and using the outcomes to refine Navy policies, would bolster the Navy’s ability to ensure swift, coordinated responses, thereby reducing operational disruptions and safeguarding the health of its personnel.

3. Communication and Training

Objective: Achieve uniform understanding and adherence to health directives across the Navy.

Action Item: The case study from Chapter IV, “Strategic Response to a Global Crisis: The U.S. Navy’s Proactive Face Covering Directives during COVID-19,” the USS *Theodore Roosevelt*’s COVID-19 outbreak, and the subsequent challenges in containment shows the importance of clear communication to personnel due to initial delays in communicating the severity and scope of the outbreak both up and down the chain of command. Instituting regular training modules and taking cues from innovative approaches, such as the “U.S. Forces Korea’s initiative of using 3D-printed tactical masks,” will ensure that all personnel are well-informed and aligned with the latest health directives and technological advancements.

4. Supply Chain Resilience

Objective: Ensure uninterrupted access to essential medical supplies.

Action Item: The challenges underscored in the “Impact of Masks Shortages on Healthcare and Essential Services” in Chapter IV, highlight the need to diversify and strengthen supply chains. Collaboration with entities like ProjectN95.org, as gleaned from the interview with Anne Miller in Chapter IV, can provide valuable insights into achieving this goal.



5. Collaboration and Coordination

Objective: Foster stronger ties with other branches, agencies, and international naval counterparts.

Action Item: The section “DLA’s Pivotal Role in Medical Supplies During COVID-19: Insights from LTC Edwin Caudell” and the interview with Kate Petti at DASN(P) from Chapter IV highlight the significance of inter-agency and international collaboration. Regular dialogues and joint exercises can facilitate the sharing of resources, insights, and strategies for the procurement and distribution of essential items (such as face masks) when there is short supply in the market.

D. FUTURE RESEARCH

This study provides an in-depth exploration into the challenges and responses of the U.S. Navy during the COVID-19 pandemic. However, there are several areas that could benefit from further research to ensure the Navy is better prepared for similar future crises.

1. Deep Dive into Face Masks NAVADMINs

While this research touched upon the Navy’s face-mask policies, a focused study on the direct impact, compliance rates, and potential improvements to NAVADMINs would be beneficial. This could involve a more granular look at the “Uniform-Integrated Face Coverings” and their long-term feasibility.

2. Operational Preparedness amid Pandemics

The case of the USS *Theodore Roosevelt*’s COVID-19 outbreak offers a starting point, but a broader study on strategies to maintain operational readiness amid pandemics is crucial. These could involve simulation exercises, scenario planning, and risk assessments.

3. Technological Innovations in Crisis Response

The U.S. Forces Korea’s initiative with 3D-printed tactical masks from Chapter IV point to the potential role of technology in addressing supply chain challenges. Future



research could explore other technological solutions for rapid response, communication, and medical support during crises.

4. Supply Chain Dynamics and Resilience

Building upon the insights from the interview with Kate Petti at DASN (P) in Chapter IV, a need exists for the Navy to comprehensively understand supply chain vulnerabilities, especially in confined environments like a naval ship, and strategies to mitigate them.

5. Inter-agency and International Collaboration

The Navy does not operate in isolation. A study focusing on the Navy's collaboration efforts with other military branches, governmental agencies, and even international naval forces during the pandemic could provide insights into best practices and areas of improvement.

6. Methodologies for Rapid Policy Formulation

Given the dynamic nature of the pandemic and the continuous influx of information, developing methodologies or frameworks for rapid yet effective policy formulation would be an area worth exploring. It would be appropriate to review how the Navy develops, implements, and gets feedback on policy changes related to public health.

E. LIMITATIONS

This thesis offers an in-depth exploration of the U.S. Navy's challenges and adaptive strategies during the COVID-19 pandemic. However, as with any study, it is essential to acknowledge its inherent limitations.

1. Limited Case Study Range

While the research delved into situations such as the USS *Theodore Roosevelt's* COVID-19 outbreak and the Navy's approach to 3D-printed masks in U.S. Forces Korea, it did not encompass the entirety of experiences from all naval operations, like the COVID-19 outbreak management on the USS *Chafee*.



2. Data Constraints

The research faced potential constraints in accessing comprehensive data. Originally, there were plans to conduct a quantitative analysis to delve into the procurement and distribution logistics of masks within the Navy, focusing on assessing the efficiency, response time, and potential bottlenecks in the supply chain. However, detailed outcomes from the management of the COVID-19 outbreak on the USS *Chafee*, and in-depth data pertaining to DLA's procurement of medical supplies were not fully accessible. This limitation hindered the ability to draw more conclusions from quantitative metrics, potentially leaving certain logistical nuances and patterns unexplored.

3. Pandemic's Fluidity

Given the ever-changing nature of the COVID-19 pandemic, the study encapsulates the Navy's response up to the midpoint of 2020, even though the pandemic's impact and challenges continued to evolve into late 2021. Subsequent developments or policy changes after this period were not covered. Furthermore, capturing, hypothesizing, or wargaming every potential outbreak and pandemic scenario was beyond the scope of this research, leaving a range of possible future challenges and responses yet to be explored in detail.

4. Interview Limitations

Although interviews, such as those from Peter Guinto at Resilinc, provide critical insights, they still present individual viewpoints and might not capture the broader sentiment or experiences across the Navy.

5. Inherent Bias

Data and insights sourced from Navy personnel or official reports might carry an inherent positive bias, potentially emphasizing successes over challenges.

6. Supply Chain Exploration

While the research addressed some supply chain challenges, a deeper dive into the intricacies, perhaps related to the mask shortages or the U.S. Navy's procurement strategies, was beyond this study's scope.



7. Generalization Concerns

The insights and conclusions derived, especially from specific case studies like the adaptation to COVID-19 protocols in the U.S. Navy from Chapter IV may not be directly transferable to other military entities or civilian organizations. This is primarily due to the unique conditions on Navy ships where Sailors are in close proximity to each other, a distinction from many other U.S. military organizations where such tight quarters may not be as prevalent.

F. CONCLUSION

Throughout this research, the adaptive and responsive measures of the U.S. Navy in the face of the COVID-19 pandemic have been brought to the fore. The U.S. Navy can improve their agility and foresight based on the lessons learned during COVID-19 pandemic to refine policy and adjust operational response. The findings and recommendations presented in this research aim to fortify these efforts, paving the way for even more robust responses in future challenges. As the Navy continues its voyage through ever-evolving global scenarios, the lessons learned from this period will undoubtedly serve as valuable anchors, ensuring the safety of its personnel while maintaining operational integrity.



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